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L'Accord Canada-Ontario relatif à la qualité de l'eau dans les Grand Lacs

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RÉSUMÉ

Le 28 janvier 1986, les ministres fédéral et provincial de l'Environnement rendaient public le rapport intitulé "St. Clair River Pollution Investigation (Sarnia Area)". Ce rapport présentait un intérêt particulier car il démontrait l'efficacité de la collaboration continue des gouvernements fédéral et provincial face à un problème particulier de pollution.

Ce document portait notamment sur la reconnaissance, les sources et les effets possibles du perchloro-éthylène dont on avait découvert des flaques au fond de la rivière St. Clair, à proximité de l'usine de Dow Chemical. Toutefois, le rapport contenait aussi 28 recommandations devant être mises en pratique afin de déceler d'autres sources de pollution et d'améliorer la qualité de l'eau, des sédiments et du biote dans cette partie de la rivière. Le but du présent document est de faire le point sur les diverses activités du ministère de l'Environnement de l'Ontario, d'Environnement Canada et du secteur industriel visant la mise en oeuvre de ces recommandations. Le présent rapport d'activité, ainsi que l'information qu'il contient, est conçu comme outil de référence pour les gestionnaires des deux ministères et du secteur privé, et pour le public.

IMPLEMENTATION OF RECOMMENDATIONS OF THE 1986 ST. CLAIR RIVER POLLUTION INVESTIGATION REPORT

INTRODUCTION

On January 28, 1986 the federal and Ontario Environment Ministers jointly released the "St. Clair River Pollution Investigation (Sarnia Area)" report. This report was particularly significant in demonstration of the effectiveness of ongoing federal/provincial co-operation in responding to an immediate pollution problem.

The report focussed on the identity, sources, and possible impacts associated with the discovery of perchloroethylene (perc.) puddles on the bottom of the St. Clair River adjacent to Dow Chemical. However, it also provided a series of 28 recommendations critical to identifying other pollution sources and improving water, sediment, and biota quality in this portion of the river. This status document is intended to report on specific Ministry of Environment (MOE), Environment Canada (DOE) and industry activities which have addressed the 1986 report's recommendations. The information in this progress report is meant as background and briefing material for managers in the two agencies, industry and for the interested public.

AGENCY PROGRAMS

The 1986 pollution investigation report was the product of on-going, past, and new or 'accelerated' activities in the St. Clair River. The accelerated studies were established to deal with contamination resulting from the August, 1985 perchloroethylene spill and the 'perc' puddles. As described in the body of this progress report, ongoing 1986/87 studies have revealed significant reductions in organic chemical loadings to the St. Clair River as well as progress on efforts to remove puddled material from the river bottom. The result of ongoing programs indicate that these programs have contributed greatly to improving the quality of the St. Clair River ecosystem. Agency programs in which

most of the ongoing work in the river are being conducted include: the Upper Great Lakes Connecting Channels Study (DOE and MOE), the Municipal/Industrial Strategy for Abatement (MOE and DOE); and the Remedial Action Plan process (MOE and DOE). Each of these programs are referred to under the appropriate recommendations. Specific tasks undertaken in the St. Clair River in support of the Upper Great Lakes Connecting Channels Study (UGLCCS) and the Municipal-Industrial Strategy for Abatement (MISA) are identified in the attached Appendices I and II respectively.

i) **Upper Great Lakes Connecting Channels Study (UGLCCS)**

This is a bi-national study initiated in 1984, addressing pollution sources and impacts in the upper connecting channels including the St. Marys, Detroit and St. Clair Rivers and Lake St. Clair. Principal participating agencies include the U.S. Environmental Protection Agency, Michigan Department of Natural Resources, U.S. Fish and Wildlife Service, U.S. Geological Survey, National Oceanic and Atmospheric Administration, Ontario Ministries of Environment, Natural Resources and Agriculture and Food, and the Federal Departments of Environment, Fisheries and Oceans, and Agriculture Canada. The objectives of the study are:

(1) To determine the existing environmental condition of the upper connecting channels.

(2) To undertake additional studies needed to:

(a) identify and quantify the impacts of conventional and toxic substances from point sources (runoff and contaminated ground-water) and tributaries, on beneficial human uses and on plant and animal populations in, along, and below these waters;

(b) determine the adequacy of existing or proposed control programs to ensure or restore beneficial uses; and

(c) recommend appropriate control and surveillance programs to protect and monitor these waterways and the downstream lakes.

It is expected that the final report of the UGLCC study will be completed by March, 1988.

ii) **Municipal-Industrial Strategy for Abatement (MISA)**

The goal of the MISA program initiated in 1985, is the virtual elimination of toxic contaminants in municipal and industrial discharges to Ontario's waterways. This will be achieved by establishing monitoring regulations and regulations requiring implementation of best available treatment technology for each industrial sector (including the organic chemicals sector applicable to the St. Clair River industries) as well as the municipal sector. Regulations will be developed following pilot studies which will investigate selected sites for each industrial sector. The St. Clair River is a MISA pilot site. Investigations were conducted during 1986 and early 1987 to provide in-depth analysis of cause/effect relationships between discharges and the receiving water environment (see Appendix II for details of Investigative components). A preliminary report of findings was released by MOE in November, 1987, and the final report for the St. Clair River MISA pilot site and draft regulations for the organic chemical industry are expected in late 1988.

iii) **Remedial Action Plan (RAP)**

Following submission of the 1985 International Joint Commission (IJC) Water Quality Board Report, provincial, federal and state governments committed themselves to developing a remedial action plan (RAP) to restore all beneficial uses in each Area of Concern. The St. Clair River is an IJC Area of Concern and as such is currently undergoing the development of a Remedial Action Plan. This plan will build upon the output from the UGLCC study final report and will require public participation in defining goals and preferred remedial options for cleaning-up the river. The current goal for the final RAP submission to the IJC is September, 1989.

iv) **Detroit/St.Clair/St. Mary's Rivers Project**

The Detroit/St. Clair/St. Marys Rivers Project Team of the Ministry of the Environment, co-ordinates provincial efforts to improve water quality conditions and to initiate additional studies as needed. This project team is providing liaison between other Provincial Ministries, Environment Canada and U.S. Federal and State Agencies.

Activities of the Detroit/St. Clair/St. Marys Rivers Improvement Project include:

(a) Coordinating the Ministry and Provincial inputs of the Bi-National Upper Great Lakes Connecting Channels Study (UGLCCS), including preparation of working group reports and editing of the final report.

(b) Coordinating the development of Remedial Actions Plans (RAPs) for each of the three upper connecting channels, including development and management of public involvement programs in Windsor, Sarnia and Sault Ste. Marie.

(c) Provision of technical, administrative and financial support to northwestern and southwestern regions and the Water Resources Branch of the Ministry of the Environment to undertake comprehensive, co-ordinated monitoring programs of effluent, ambient water quality and environmental management strategies.

(d) Directing specific studies related to non-point discharges, particularly those with a major hydrogeological investigative component. Examples are a study of the impact of former deep well disposal activities in Lambton County, Fighting Island in the Detroit River, and the Algoma Steel slag site at Sault Ste. Marie.

The following is an outline of the implementation of the **General, Ambient and Source** recommendations stated in the January, 1986 Pollution Investigation report.

GENERAL RECOMMENDATIONS

G1. The sediment, water, point source and biota findings of the current study should be reviewed by the technical Work Groups of the Upper Great Lakes Connecting Channels Study (UGLCCS) in the February 1986 workshop with a view to amending and augmenting the UGLCCS workplan where warranted.

An overview of the Dow Chemical spill and the findings of the study were presented to the workshop by DOE and MOE representatives. The technical Work Groups were requested to review and amend the 1986 field season work plan. The revised work plan was formally released in June of 1986 and included studies directly related to contaminants in the St. Clair River (see Appendix I).

G2. Government and industries should accelerate investigations of available technologies and systems for maximizing control over the discharge of toxic substances to the St. Clair River. These investigations should address the specific provisions of Article VI and Annexes 8, 10 and 12 of the 1978 Great Lakes Water Quality Agreement, and should lead to the establishment of quantitative discharge limits for each contaminant of concern, based on "achievable technology" and any further stringency imposed by receiving water quality considerations.

In June 1986, the Ontario Ministry of the Environment announced the MISA "Municipal-Industrial Strategy for Abatement" - program. This new approach to controlling point-source water pollution has as the ultimate goal the virtual elimination of toxic contaminants from all industrial and municipal effluent discharges into the province's waterways. Technical committees consisting of MOE/DOE and industry representatives for each industrial sector will recommend practical and effective best available technology

treatment requirements economically achievable for each sector. The program is being developed in consultation with Environment Canada, industries, interest groups and the general public.

Initially, dischargers will be subject to Monitoring and Reporting Regulations which will require them to identify and measure concentrations and amounts of toxics in their effluents. This self-monitoring program will be audited by the Ministry of the Environment.

This initial monitoring phase will be followed by Compliance or Limits Regulations that will specify allowable concentrations, as well as amounts or loadings, of toxic pollutants for each discharger. This will be done on a sector-by-sector basis and the specified levels will be based on the Best Available Technology Economically Achievable (BATEA)

More stringent effluent limits may be required for specific sites to protect sensitive water bodies. This action would occur in cases where water quality assessments indicate that controls beyond those required by BATEA may be necessary to protect the environment. The St. Clair River MISA Pilot Site Investigation is aimed at establishing suitable water quality assessment techniques to derive effluent requirements based on receiving water quality.

The recommendations will be reviewed in the light of Annexes 2, 13 and 14 of the 1987 protocol to the Great Lakes Water Quality Agreement.

G3. Ambient water quality objectives for the volatile and chlorinated organic compounds in the St. Clair River should be established as a matter of priority.

Working Group I of the MOE Water Management Committee has been charged with development of Provincial Water Quality Objectives (PWQO) for chemicals of concern documented in the MOE Effluent Monitoring Priority Pollutants List (EMPPL). Contaminants which form the EMPPL are listed based on potential exposure and effects.

PWQO's have been established for chlorinated phenols and chlorinated benzenes since release of the 1986 St. Clair River Pollution Investigation Report. Future work on setting objectives/guidelines will be carried out as part of the MISA process in establishing requirements for discharges to the St. Clair River and will be completed by December, 1988.

G4. Better definition of the fate and pathways of contaminants in the St. Clair River ecosystem, with particular emphasis on carbon tetrachloride, perchloroethylene, hexachlorobenzene and hexachlorobutadiene, is urgently required.

MOE and DOE modelling efforts are contributing to the UGLCCS with a view to developing management tools for remedial actions. To achieve this end, studies ranging from mass balance determinations and sediment transport to chemical fate and transport modelling are being conducted by a number of co-operating agencies.

The St. Clair MISA pilot site preliminary report provides an insight into cause/effect relationships through presentation of findings from sequential sampling (see Appendix II). Consultant activities on behalf of MOE have enabled fate and transport modelling of Hexachlorobenzene (HCB). Preliminary results predict that most of this material will become dissolved and/or adsorbed to suspended material in the water column. Small fractions are predicted to be lost to the atmosphere or sediments. Concurrent activities involve the application of mathematical models to these findings as well as other contaminants.

A contract for development of an enhanced model which further explains contaminant fate in the aquatic food chain and bed sediments is presently underway through a consultant retained by the MOE. In addition, a modelling seminar/workshop organized by MOE was held July 9-10 at Seneca College to refine the modelling food-chain component. This will enable a practical and useful level of sensitivity for modelling contaminant uptake by aquatic organisms.

AMBIENT RECOMMENDATIONS

A1. Identity and probable sources of sediment contamination that persist in the deeper layers of cores collected in the vicinity of the Ontario shoreline of the river should be investigated.

A study of non-chlorinated aromatic compounds in St. Clair River sediments was completed by the National Water Research Institute (NWRI) of Environment Canada. The study revealed extensive contamination of sediments on the Canadian side downstream from Sarnia by chemicals used in commercial heat transfer fluids. Two of the compounds identified are biphenyl and diphenyl ether.

Their presence may be significant if they can reach downstream water treatment plants and become chlorinated to form chlorinated biphenyls (PCBs) and chlorinated diphenyl ethers (CDPEs). A journal paper on the results is in the final stages of preparation and should be completed and submitted by 1988.

Several chlorinated aromatic compounds were detected and tentatively identified during the 1985 St. Clair River Pollution Investigation in sediments near Dow which were not present in the tarry material. NWRI scientists have now confirmed the tentative identities by synthesis of the compounds in the laboratory. The compounds appear to be related to the herbicides 2,4-D and 2,4,5-T but are not present in several commercial samples of 2,4-D that were analysed. It seems likely that they form as impurities during the synthesis of the herbicides. Since there is no record of either 2,4-D or 2,4,5-T being manufactured in Sarnia, the presence of these compounds is surprising and remains to be explained. Further laboratory work to confirm the route of their formation is underway. A paper is expected to be completed by March, 1988.

To address concerns over possible impingement of these contaminants at downstream water treatment plants, the Ministry of the Environment has initiated several studies.

The Drinking Water Surveillance Program (DWSP - see recommendation A8) has sampled all municipal water treatment plants downstream of the Chemical Valley for a total of 139 parameters. PCBs have not been detected in any water supplies.

Further studies currently underway by the MOE include sampling of bottom water and sediments in the vicinity of water treatment plant intakes to determine the impact of resuspended bottom sediments. In addition, the Great Lakes Institute of the University of Windsor, under a research grant from the Ministry, is assessing uptake of contaminants by clams exposed at raw water intakes.

Results from both studies are pending and follow-up work will be conducted where warranted.

A2. **Sources of volatile hydrocarbons particularly carbontetrachloride and perchloroethylene, in the study area should be investigated and reduced.**

Point source monitoring conducted jointly by MOE and DOE during 1986 provided an inventory and characterization of contaminants discharged to the St. Clair River. This study was not limited to the organic chemical sector and is therefore representative of a number of dischargers in the Chemical Valley.

Intensive effluent monitoring, as documented in the St. Clair River MISA pilot site preliminary report indicates that the 42- and 54-inch sewers from the DOW 1st St. complex contain the highest levels of carbontetrachloride and perchloroethylene. It should be noted that results from May 1986 sampling indicate the DOW 4th St. sewer now emits an increased perchloroethylene loading to the St. Clair River versus non-detectable levels measured in 1985 due to the diversion of some of the 1st Street plant effluents to the 4th Street outfall via Block-90 pond. This enabled Dow to shut down and permanently seal the 30" acid tile sewer. However, total perchloroethylene loadings from DOW have been reduced 79% from approximately 13.5 kg/day in 1985 to 2.8 kg/day in September, 1986.

Carbontetrachloride loadings have been reduced by 95% from 25.7 kg/day in 1985 to 2.4 kg/day in September, 1986. (See Source Recommendations - 1 and 7).

A3. The apparent increase in concentration of hexachlorobenzene in sediments between the CN tunnel and the Township ditch on the Ontario side should be investigated.

Investigations carried out by the Ministry of the Environment and the National Water Research Institute in 1986 confirmed 1985 findings in which surficial sediments (top 3 cm) downstream of the CN tunnel and upstream of the Cole drain (township ditch) contained HCB levels up to 10 times upstream control levels.

Elevated HCB levels measured in November, 1985 and in 1986 may have occurred through deposition of contaminated solids discharged via the Sarnia Sewage Treatment Plant. Dynamic bed conditions in this vicinity from high flow rates may result in a scoured or altered bottom and makes comparisons between years difficult.

A4. The apparent increase in the concentration of hexachlorobenzene in sediments in the vicinity of the CN tunnel on the Michigan side should be investigated.

Sediment core samples could not be obtained at this location during 1986 likely as a result of scouring. Seasonal accumulation prior to November 1985 may have enabled a sample to be obtained at that time. A follow-up study is being planned.

A5. Sources of the carbontetrachloride and perchloroethylene in waters upstream from the CN tunnel should be identified.

Intensive pilot site investigations of water do not indicate elevated volatile compound levels near or upstream of the CN Tunnel, however, perc. and carbontetrachloride could originate with combined sewer overflows (CSOs) since the Sarnia WPCP receives these chemicals in its influent (UGLCCS point source data) and there are 2 CSOs upstream of the CN Tunnel.

A6. The presence of high concentrations of mercury in sediments opposite Dow property should be investigated.

As part of the St. Clair River MISA Pilot site investigation, the Ministry of the Environment established a fine sampling grid for surficial sediments adjacent to the DOW property during 1986. Results confirm findings of the 1986 MOE/DOE St. Clair River Pollution Investigation Report. Twice weekly measurements of mercury levels in the effluent from DOW indicate low but persistent loadings of 5 g/day from the 1st St. 54-inch sewer. All other DOW sources contribute minimally, with typical concentrations less than 0.03 ppb. High discharge rates at the DOW 4th St. sewer have produced loadings consistently in the 2.5 g/day range; however, intermittent peaks may be responsible for loadings upwards of 0.1 kg/day. Further results from the 1986 UGLCCS effluent study have revealed Hg loadings from the 54-inch sewer of 2-32 g/day, while 0-24 g/day loadings were noted for the DOW 4th St. sewer.

A7. Sources of hexchlorobenzene, octachlorostyrene, pentachlorobenzene and PCBs in the area between Talfourd Creek (Shell Canada) and Petrosar should be identified and action initiated to reduce or eliminate these compounds.

The Ministry of the Environment carried out a monitoring program in the Talfourd Creek watershed in 1986. Results are currently being interpreted. MOE investigations of the Unitech Landfill site as well as in the Talfourd Creek in the vicinity of the site shows no significant changes in water quality downstream from the landfill site. Further work is being conducted in the watershed to determine if Talfourd Creek is a source or if contaminants enter from upriver.

A8. The drinking water surveillance program should be continued at water treatment plants on the St. Clair River.

The Ministry of the Environment Drinking Water Surveillance Program (DWSP) has been ongoing on a monthly basis at Sarnia, Wallaceburg,

Walpole Island and Windsor during 1987. A more extensive grid during 1986 included those noted above as well as Amherstburg, Mitchell's Bay and Stoney Point. These latter three are currently sampled once per year.

A9. **Ontario drinking water criteria and objectives should be developed for 1,2,4,5-tetrachlorobenzene, 1,2,3,5-tetrachlorobenzene, pentachlorobenzene, benzene and carbontetrachloride, all of which have been found in the St. Clair treated drinking water.**

Those compounds found in treated water for which Ontario Drinking Water Guidelines are not available were identified to the Federal/Provincial Sub-Committee on Drinking Water, with a request for guideline levels to be developed.

The process of setting drinking water guidelines is highly complex and time-consuming and the Sub-Committee is continuing to assess the available information on these compounds according to the criteria established in their guideline-setting process.

A10. **Contingency drinking water treatment technology should be developed for use after chemical spills, i.e., mobile treatment units.**

All major industries in the Sarnia area were requested to prepare and submit spill contingency plans. These plans have been submitted by the industries and the Ministry has reviewed them. Further action will be taken on any deficiencies in these current spill contingency plans.

A spill manual has been developed by the Ministry of the Environment which will enable relatively rapid and easy-to-use spill impact assessments, to determine the effect of spills within the "chemical valley" upon selected downstream water intakes. Using a minimum of input parameters, the manual is able to provide a quantitative value of the peak contaminant concentration and its time of arrival at a selected water intake. It also provides the times of arrival and departure, and thus the duration time of the beginning and end of the spill-plume at the water intake.

The provincial Optimization Study, in conjunction with the Drinking Water Surveillance Program, will examine the optimization of treatment technology for the removal of turbidity and trace organic contaminants from drinking water under all operating conditions.

Emergency treatment technology and design criteria are presently being evaluated. It is expected that a suitable mobile treatment facility may be developed probably with the help of the private sector once the gaps in the individual plant treatment technologies have been identified.

The accepted contingency treatment for organic trace contaminant removal from drinking water is the application of powdered activated carbon (PAC). This treatment process is presently employed on a full-time basis at Walpole Island, Wallaceburg, Mitchells's Bay and Amherstburg Water Treatment Plants.

The effectiveness of granular activated carbon contactors will be assessed pending the outcome of the Niagara River pilot-plant study, which is designed to determine the efficacy of such contactors in the removal of specific contaminants of concern.

A11. Additional efforts in analytical development should be undertaken to allow more precise analyses of polychlorinated aromatic hydrocarbons and polychlorinated dibenzofurans in young-of-the-year spottail shiners.

The Ministry of the Environment has always been aware of the need to expand the range of contaminant residue analysis in aquatic biological tissues (young-of-the-year fish, sport fish, clams, etc.). Over the past 15 years, the range of metals, pesticides and industrial organic substances measured in biological samples has grown steadily. Recently, the analysis of chlorinated phenols, chlorinated benzenes and polynuclear aromatic hydrocarbons (PAHs) have been added.

With respect to dioxins and dibenzofurans, it must be acknowledged that accurate testing for these compounds in biological tissues in the low parts-per-trillion range is an extreme challenge to analytical chemists. MOE has had the capability to measure 2,3,7,8-TCDD, the most toxic of the dioxin isomers since the early 1980s. However, today 2,3,7,8-TCDD analysis is not enough. Other congener groups and specific toxic isomers of both dioxins and dibenzofurans are needed for an adequate assessment of the environmental and health significance of these compounds. MOE has dedicated scientific staff resources and substantial capital expenditures to develop, test and, ultimately, apply techniques to measure the broad range of these compounds. Until the techniques meet Ministry standards and accurate results are assured, broad-based testing of fish for dioxins and dibenzofurans has been suspended. It is currently expected that testing of fish from Ontario's lakes and rivers, including the St. Clair-Detroit River corridor, will resume in early-to-mid-1988.

A12. Additional species of sport fish from Lake St. Clair and Lake Huron (control) should be analyzed for chlorinated benzenes, furans, polyaromatic hydrocarbons and substituted phenols. This is a critical requirement, given the importance of the recreational fishery and the high public utilization of fish from Lake St. Clair.

The Ontario Ministry of the Environment is aware of the importance of Lake St. Clair to the angling public and has given special attention to sport fish testing in this part of the province for many years. Twenty species of fish are collected and tested for a wide range of metals (most notably mercury), pesticides and industrial organic compounds. Recently, the analytical range has been expanded to include chlorinated phenols and chlorinated benzenes. With the exception of HCB which has been measured for many years, chlorinated benzenes and phenols are, to this point, not being detected in Lake St. Clair fish. PAH analysis is just now being started and results will become available soon.

With respect to dioxins and dibenzofurans, the current status is described in response to recommendation **"A11"** above. When the analytical procedures for testing are ready for application, fish from the St. Clair area will be tested and reported.

A further recommendation identified in the ambient section of the 1986 St. Clair River Pollution Investigation report follows:

Evaluation to ascertain the effect of contaminated sediments on the biota and water column should be undertaken.

Sediment bioassay tests, as well as investigations of sediment chemistry, contaminant levels in benthos and sculpins and benthic enumerations, have all been undertaken as part of the St. Clair River MISA pilot site study. Preliminary results have been reported in Volume I of the pilot site report. Final results will be reported in the MISA pilot site document scheduled for October, 1988. (See also General Recommendation - 2).

SOURCE RECOMMENDATIONS

S1. The effluent levels of volatile organics, particularly perchloroethylene and carbontetrachloride from Dow, should be reduced.

Perchloroethylene and carbontetrachloride loadings from DOW sewers, estimated from sampling during May to September, 1986, have been reduced 79 and 95% respectively as compared to levels estimated in November, 1985. Reductions of 71 and 79% were noted for perchloroethylene and carbontetrachloride loadings from the Dow 42-inch sewer, in comparing estimates for November, 1985 to twice-weekly 1986 sampling.

Total volatile loadings which includes perchloroethylene, carbontetrachloride and other compounds have been reduced 83% (360.3 kg/day to 62.2 kg/day) from November, 1985 when compared to loading estimates for May, 1986 sequential sampling. Perchloroethylene levels in the DOW 4th St. effluent have increased over 1985 levels due to a diversion of the Acid tile sewer drainage previously discharged to the St. Clair River via the 1st St. complex.

S2. Based on the findings of water and sediments, Dow effluent levels of persistent chlorinated organics, notably hexachlorobutadiene and hexachlorobenzene, should be reduced.

Average loadings of hexachlorobenzene and hexachlorobutadiene have been reduced by 76% and 80% respectively when comparing levels measured in May - September, 1986 twice-weekly sampling with November, 1985 levels.

Total chlorinated hydrocarbon loadings including the above compounds have been reduced 82% (1 kg/day to 0.185 kg/day) from November, 1985, when compared to loading estimates for May, 1986 sequential sampling.

S3. **The effectiveness of the Dow Scott Road Landfill carbon treatment facility should be investigated. Modifications should be implemented to reduce losses of persistent chlorinated organics, especially hexachlorobenzene and hexachlorobutadiene.**

As part of the Upper Great Lakes Connecting Channels study, the Ontario Ministry of the Environment, Environment Canada and DOW Chemical sampled input to and outflow from the Dow Scott Road carbon treatment beds. Results are currently being analyzed.

Dow Chemicals' assessment regarding optimization of the treatment facilities at the Scott Rd. Landfill site revealed that the carbon beds may need to be recharged more frequently in order to facilitate removal of volatile hydrocarbons.

Dow formally submitted an application in June, 1987 for closure of the Scott Road landfill site. Additional information requested of DOW is currently being reviewed by DOE and MOE staff. A study aimed at assessing the presence of 2,4-D and 2,4,5-T reveals that levels found in the leachate were well below toxic limits for aquatic life.

S4. **Additional sources of chlorinated organics to the Scott Road outfall, 1,2-dichlorobenzene and 1,2,4-trichlorobenzene in particular, should be investigated.**

S5. **Sources of chlorinated organics to the Township ditch (Cole Drain), in addition to those coming from the Scott Road outfall, should be investigated.**

MOE initiated a consultant study during 1986 to identify potential sources of contaminants in the area surrounding the Cole Drain and the Scott Road landfill. The initial stage involved sampling of all tributaries entering the site during dry and wet weather. A report outlining the findings of this initial phase is expected by the spring of 1988. The second stage will involve development of recommendations for remedial actions as necessary.

DOE also conducted a survey of the Cole Drain in June, 1986 as part of UGLCCS. Results will be forthcoming as part of the UGLCCS final report (March, 1988).

S6. **The source of benzene in the Polysar 72" sewer and of ethylbenzene and benzene in Dow's sewers should be identified and treated.**

The source of benzene in the 72" sewer was caused by a leaking heat exchanger. Polysar located and repaired the leak. The company has implemented improved maintenance programs to avoid excessive leaks.

Sources of ethylbenzene and benzene previously identified at Dow have been re-routed for additional treatment. Effluent monitoring results as part of the MOE-MISA pilot site investigation have not indicated the presence of benzene and ethylbenzene in any final effluent from DOW.

S7. **Volatile hydrocarbons in all sources in the Chemical Valley, particularly carbontetrachloride and perchloroethylene, should be reduced.**

In addition to those reductions previously noted (General -2; Ambient -2) for DOW Chemical, further studies including the UGLCCS have revealed that the Cole Drain, Polysar, Ethyl Canada and the Sarnia Sewage treatment plant are additional sources of volatiles in the "Chemical Valley". Remedial measures are presently being implemented to reduce contaminants entering the Cole Drain. (See Source Recommendation -3).

Under UGLCCS, DOE and MOE sampled, during 1986, all Canadian industrial and major municipal point sources along the St. Clair River for volatile hydrocarbons. The results will be used by the Ontario MISA program to assist in setting effluent control limits for volatile organic hydrocarbon releases.

The following major industries were surveyed by DOE and MOE during 1986:

Esso Petroleum, Esso Chemicals Canada Ltd., Polysar Ltd., Dow Chemical Canada Inc., Suncor, Shell Canada Ltd., Ethyl Canada Ltd., Union Carbide and CIL Inc. In addition, the following municipal water pollution control plants were surveyed: Sarnia, Point Edward and Corunna. Three additional industrial sources were also sampled less intensively: Lambton Generating Station, Dupont Canada Inc. (Corunna), and Chinook Chemicals Co.

S8. To ascertain the extent of possible ground-water contamination in the Sarnia area, studies are required to:

(i) Define the ground-water flow pattern in the freshwater aquifer.

(ii) Assess water quality in the fresh water aquifer and seepage discharge to the St. Clair River.

A contract has been let by MOE to define the ground-water flow pattern in the freshwater aquifer and to determine the hydraulic head relationships between the freshwater aquifer, the rocklayers above the Detroit River Group, and the deep well disposal zone.

A total of 29 monitoring wells have been installed to date. Ongoing work includes the application of models to quantify loadings (if any) to the St. Clair River. A deep bore-hole equipped with special casings to gather hydraulic and geochemical information from different geologic formations is presently being installed. Freshwater aquifer samples are to be submitted for analyses for a complete range of organic compounds.

Preliminary ground-water and deep well monitoring results as part of the UGLCCS, are presently available and will be combined with ongoing data collections for inclusion in the UGLCCS final report expected by early-to-mid-1988. A final consultants ground-water report is to be submitted by the end of 1988.

A brief chronology of remedial measures carried out by industries in the Chemical Valley both prior to and following the 1986 St. Clair River Pollution Investigation Report follows:

Dow

- Construction of a system to separate process wastewater from uncontaminated cooling water to allow more effective removal of contaminants prior to discharge at a total expenditure of $600,000. In addition, the First Street Acid tile sewer, identified as a source of the "perc puddles" was shut down and permanently sealed.

- Upgrading of spill prevention facilities at a total expenditure of $2.1 million. The bulk of this money ($1.6 Million) went to building or upgrading water containment reservoirs to improve the collection of contaminated water (primarily from the 1st Street chemical plants) and permit treatment prior to discharge. The upgrading of dyking around processing equipment accounted for a further $500,000.

- Installation and upgrading of treatment systems at various process units (e.g. the styrene, solvents and latex plants) at a cost of $1.6 million. These treatment systems will be capable of removing contaminants from waste waters and atmospheric vent gases (steam strippers).

- The construction of a 302 m riverfront barrier wall and extraction well system to eliminate the potential of sub-surface migration of chemicals from the plant site to the river. Construction of the wall, which extends vertically 6 to 9 m below grade, began in May 1986 and was completed five months later at a cost of $1.3 million.

These actions have resulted in a measured loading decrease of 83% for total volatiles and 82% for total chlorinated hydrocarbons.

This reduction has been measured through comparison of May, 1986 sequential field results (MISA) with findings of the 1986 MOE/DOE pollution investigation report.

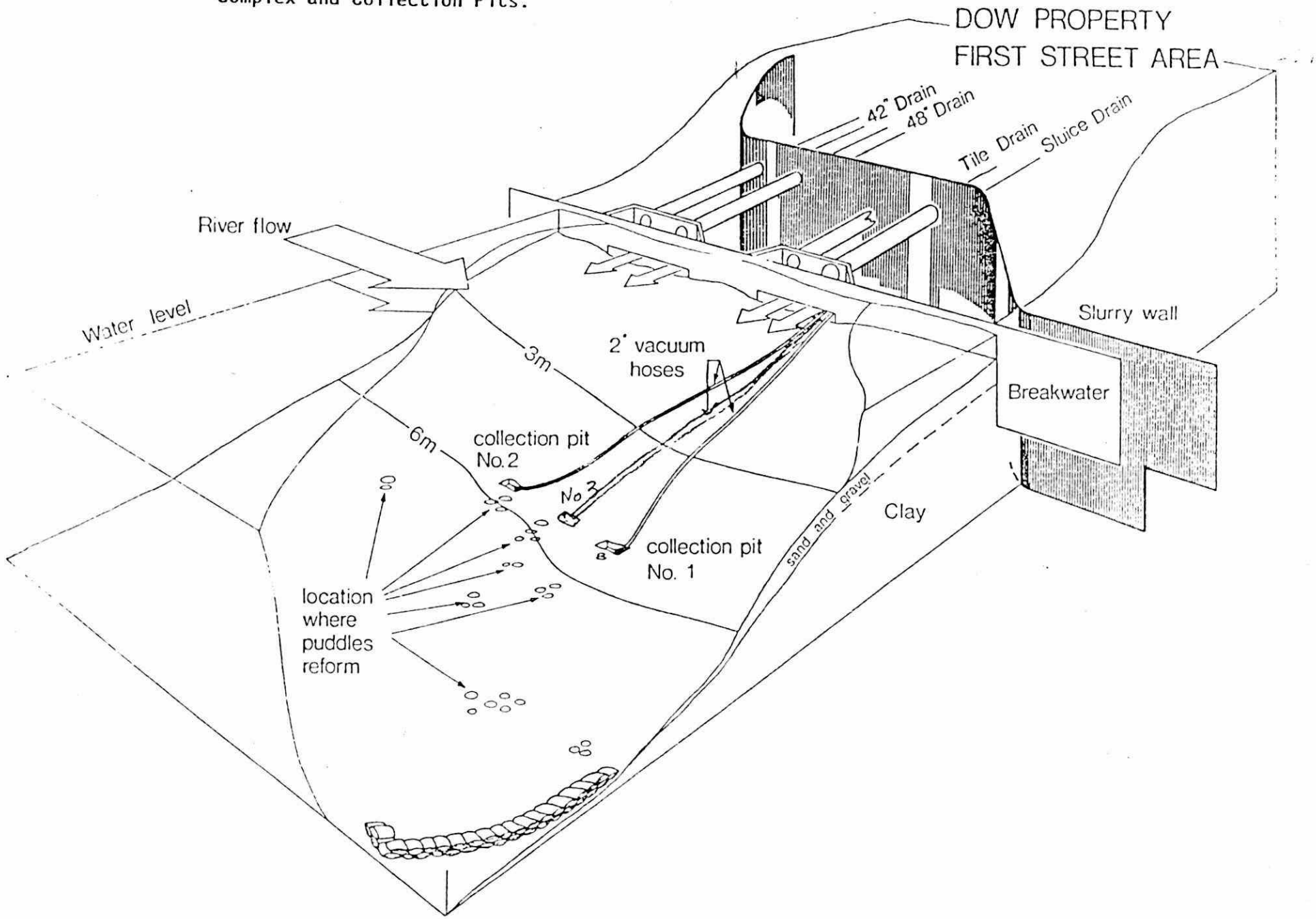
Information supplied by Dow on samples obtained subsequent to May, 1986, indicates continuing improvements in effluent loadings. This data will be verified as part of the MISA monitoring program. Dow Chemical has also been involved in ongoing clean-up programs since the discovery of a source of perchloroethylene in late 1985.

The source through the 1st St. sewer (called the tile drain or 30" sewer) was completely cut off in February, 1986. Since that time puddles have been found to reform continuously. Dow Chemical has recovered the puddle material through weekly (bi-weekly on occasion) pumping from sump holes or collection pits (Figure 1), and by periodic vacuuming of the whole area (50 m X 50 m) by diver-operated suction lines.

This cleanup program has recovered material at rates that started around 3 L day $^{-1}$. Recovery rates now are less than 0.3 L/day with long periods when the collection pits are empty. The total amount recovered between January, 1986 and October, 1987 is approximately 780 L (Figure 2). Very rough estimates of loss to the river by dissolution suggest that these recoveries represent about 70 and 80% of the material that seeps out of the sediment except when ice or other mishaps temporarily interfere with the recovery period.

A coring survey of the clean-up area by Dow Chemical in August and September of 1986 revealed that there was adequate puddle material contained in the coarse sand and gravel layer (on top of the relatively impermeable clay base) to account for the puddle material being recovered. Some of this liquid chemical mixture is still present in the sand and gravel.

Figure 1: Diagram of Clean-Up Site showing Dow 1st Street Sewer Complex and Collection Pits.



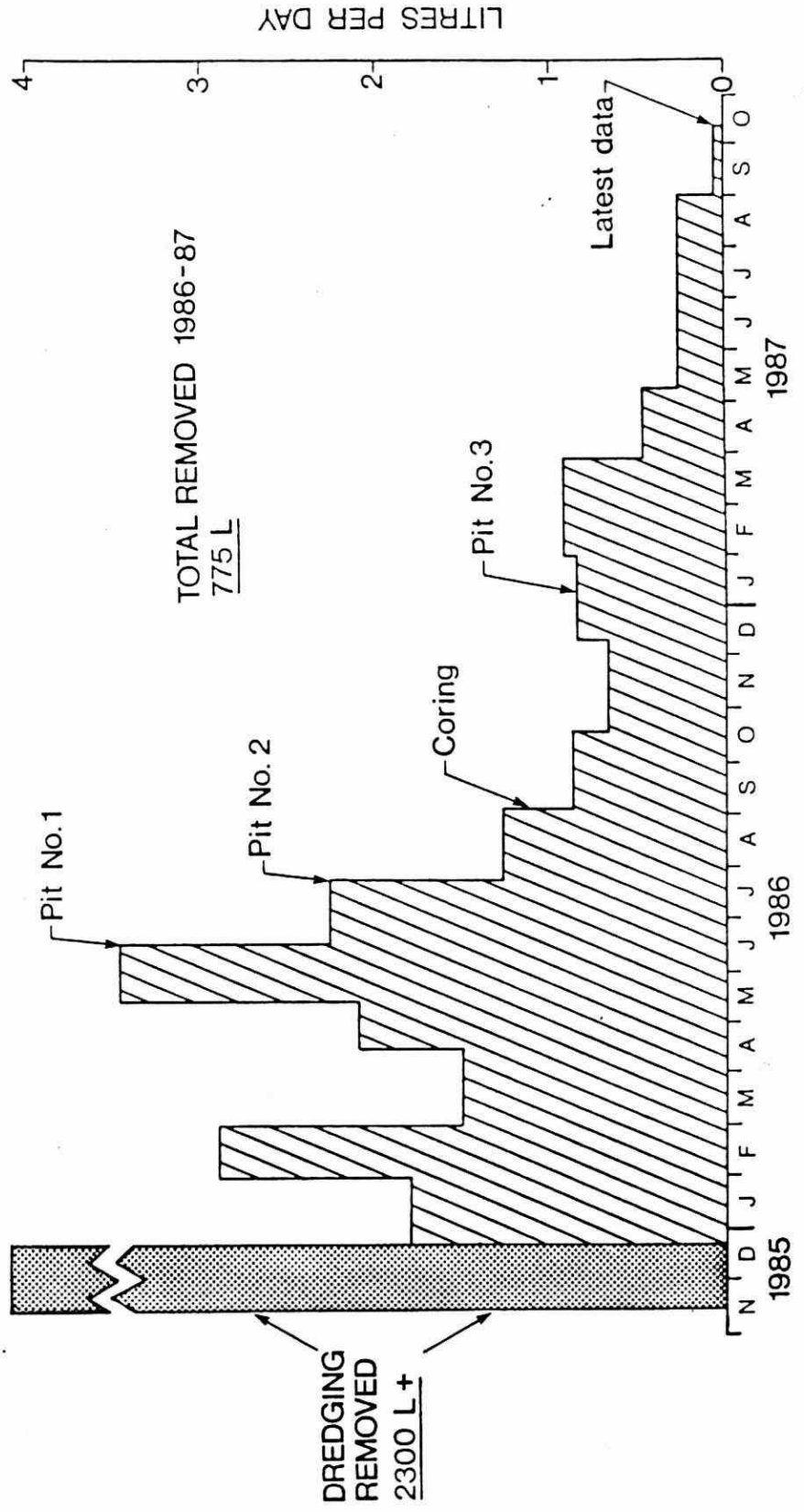


Figure 2: Rate of Recovery of Liquid Chemical from the St. Clair River Bottom by Dow Chemical Canada Inc.

In order to assess the potential impact of these contaminated sediments on the ecosystem, Dow was requested to undertake a comprehensive review of available sediment data for the riverbed adjacent to their property. Terms of reference for the project outlined a list of target compounds associated with Dow effluent and a number of environmental concerns as they relate to these contaminated sediments.

A draft report has been prepared by Dow and is presently being reviewed by MOE and DOE staff. The report includes discussion of Environmental Impact and Human Health Risk Assessment.

The need for further remedial action is being assessed while the cleanup continues on a regular schedule.

Suncor

Suncor implemented a wastewater treatment plant upgrading program in 1986 at a cost of approximately $5 million. In addition to treatment plant upgrading, wastewater holdup capacity was increased to provide storage for storm water overflow. This allows for reprocessing of storm water through the treatment facilities.

Both the new and existing impounding basins have had polyethylene liners installed to prevent the erosion of the basin walls and the leaching of material into the surrounding soil.

Polysar Ltd. (Sarnia)

Polysar constructed a biological oxidation plant to treat process streams at a cost of $25 million. This plant came on line in 1982. They have also constructed a pipeline to transfer leachate from their Scott Road landfill to the company's treatment unit prior to discharge to the St. Clair River.

Esso Chemicals Canada Ltd.

Although no physical changes have occurred at the plant since November, 1985, Esso Chemical has placed greater emphasis on minimizing the loss of material to the sewers, as well as optimizing the operation of the wastewater treatment system.

Esso Petroleum Canada Ltd.

Esso has invested over $20 million on environmental improvements at the Sarnia Refinery over the last five years, including $5.7 million during 1986. Projects included:

(a) Improved storm water handling and diversion capabilities to avoid hydraulic overload of the treatment system.

(b) Upgraded existing wastewater treatment facilities, including increased oxygen supply to the biological treatment plant for improved aeration of the wastewater.

(c) Prior to 1980, drainage from the Esso Petroleum tank farm was treated through a gravity separator before being discharged to the Cole Drain. The company has installed a pipeline directly to their biological treatment plant where the leachate is treated prior to discharge.

Cabot Canada Ltd. (Carbon Division)

In 1984, the company constructed a storm water collection and treatment system.

Polysar Ltd. (Corunna)

In 1984-85, the company initiated a program for the optimization of their existing Biox plant. This resulted in a significant decrease in phenol loadings.

Fiberglas Canada Inc.

In 1983, the company completed remedial work on its landfill situated on Scott Road, and closed the facility. This effectively addressed the problem of phenolic leachate gaining access to local storm drains.

Shell Canada Ltd.

The upgrading of a storm collection and treatment system at a cost of $3.3 million will be completed by February, 1988.

Ethyl Canada Inc.

The company has undertaken a program for the recycling of process waters, resulting in significant reductions in total loadings of contaminants to the St. Clair River.

Chinook Chemicals Co.

A closed-loop spray irrigation system to treat potentially contaminated water was completed in 1983.

A number of these companies have undertaken a program to improve source separation of process wastewater streams resulting in lower loadings to the treatment system, thus helping to prevent hydraulic overload.

APPENDIX I

UGLCCS Activity No.	Title and Specific Activities
C.3	Decision making models for UGLCCS Contaminants
	- Fate of HCB in St. Clair River
C.5	Unsteady Flow Models of the St. Clair River and Detroit River
D.7	Point source surveys (St. Clair River 1986).
E.4	Site Specific Investigations to Obtain Required Data Where Necessary for Prioritized Waste Sites and Calculation of Loadings
	- Ground-water Monitoring - 3 to 4 Sites in St. Clair River area.
E.5	Deep Well Disposal Assessment, Lambton County, Ontario
E.6	An Assessment of the Seepage of Ground-water into the St. Clair River
F.1	Evaluation of Ambient Monitoring Data from the St. Clair and Detroit River
F.3	Supplementary Analysis of Ambient Water for Selected Contaminants
	- St. Clair River Water Quality Monitoring Station - St. Clair River Water Quality Surveys
F.4	Support for Mass Balance Models on the St. Clair River and Detroit River System

APPENDIX I (con't)

UGLCCS Activity No.	Title and Specific Activities
F.7	Tributary Monitoring Program - Special study to monitor St. Clair River tributaries: Murphy Drain, Talford Creek and Township Ditch.
G.1	Bottom Sediment Mapping - Sample and map sediments in upper St. Clair River.
G.2	Bottom Sediment Monitoring for Organic Toxics and Heavy Metals - Sample sediments, collect and analyze cores in upper St. Clair River - Assessment of Bottom Fauna and Sediments of St. Clair River - St. Clair River Enhanced and Special Tributary Monitoring Programs.
H.1	Community Structure Assessment, Distribution and Production of Benthic Macroinvertebrates - 1985 Assessment of the Bottom Fauna and Sediments of St. Clair River - Distribution of Yeast/Fungi - St. Clair River - Community Structure Assessment, Distribution and Production of Benthic Macroinvertebrates.

APPENDIX II

The St. Clair River MISA Pilot-site investigations deal with four major components:

1. Sequential Sampling
2. Effluent Monitoring
3. Ecosystem Monitoring
4. Investigative Sampling

Sequential Sampling: Designed to address the effects of discharges from Dow Chemical, the Cole Drain and the Polysar 72-inch sewer on the area in the vicinity of the Ontario shoreline. This sequential sampling entailed the collection of effluent and ambient samples at half hour intervals for a 7 hour period from 12 intakes/outfalls and 7 river stations. Data generated from the sequential sampling which are presented in the MOE November, 1986, preliminary report are being used to calibrate and validate dispersion and fate models.

Effluent Monitoring: Sampling of the Cole Drain, Polysar Biox Unit, Polysar 72-inch; Dow 42-, 48-, 54-inch sewers (1st St. complex) and Dow 2nd, 3rd and 4th St. sewers, took place on a two times per week basis.

Data generated from this effluent monitoring will provide insight into loadings of organics discharged to the St. Clair River. These data will also facilitate interpretation of information collected at the ecosystem stations by providing indications of longer term temporal trends complimenting the "snapshot" in time highlighted by sequential sampling.

Ecosystem Monitoring: The understanding of the behaviour of contaminants in different biota compartments should lead to a successful application of fate and transport models. Body burden

analyses were carried out for benthos and sculpins, spottail shiners, cladophora, clams, macrophytes and phytoplankton. An attempt was also made to estimate total biomass. Effluent toxicity and mutagenicity tests were also carried out.

Investigative Sampling: This component was aimed at determining the concentration of trace organics at the sediment-water interface. Forty-three stations were sampled from the river headwaters to the St. Clair River Delta.